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ABSTRACT

A study investigated whether the computer anxiety of novice users would be reduced more with graphic user interfaces than with command line interfaces. Computers have become an integral part of communication research, and undergraduates are being required to take research courses that necessitate the use of computers. Forty-five students enrolled in an undergraduate communication research course at a large urban university in the Midwest participated in the study. Subjects ran a computer program using either command line or graphic interfaces. Pre- and post-tests measured computer anxiety. Results indicated that interface does not have an effect on the level of computer anxiety for novice users. Results further indicated that there seems to be no simple solution to computer anxiety for novice users. The use of graphic user interface, no matter which platform is employed, does not reduce novice user anxiety. (One table is included; 17 references are attached.) (PRA)

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An Analysis Of The Use Of Command Line And Graphic Interface In Computer Instruction For The Communication Research Course

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An Analysis Of The Use Of
Command Line And Graphic Interface
In Computer Instruction For
The Communication Research Course

Weaver (1953) pointed out that for our culture words like research and computer are "devil" terms while at the same time they are "god" terms. To scholars in communication, research is a "god" term but for many of our students research is a "devil" term. The word computer was perceived as a "god" term. The computer was envisioned as being omnipotent. As computers became more accessible they became a devil term. Computer anxiety has become a major problem in our technological society.

Undergraduates are being required to take research courses that necessitate the use of computers. A survey by Frey and Botan (1988) found that 53.3% of communication departments teach communication research. Course activities include statistical assignments with and without the use of the computers. Respondents to this survey reported the number one change in communication research courses they hoped to see was an increase in the use of computers. Computers have become an integral part of communication research.

Many students find the experience with the computer unpleasant (Marcoulides, 1989). The use of computers has

added to the math anxiety experienced by many communication students taking a research course. Rosen, Sears and Weil (1987) found that there is a relation between academic major and computer anxiety. Students majoring in arts and letters suffer greater computer anxiety. Students do not major in communication because of computer anxiety but communication majors suffer from computer anxiety. Some students chose communication as a major to avoid math and computers. The avoidance of math and computers in communication may not be possible in the future. Rosen, Sears and Weil state:

> In the near future, it is likely that computer interaction will be an integral part of most academic majors, leaving the computerphobic with limited options (p. 178).

My first experience with computers came as an under graduate at Michigan State University. As a freshman I was assigned to a beginning public speaking class that met in the University Computer Center. On the first day of classes I wandered through the Computer Center looking for my speech classroom. I found a room marked computer viewing room. Having looked everywhere else for my speech class I went in. The viewing room was air-conditioned, rather unusual for a university building twenty seven years ago. It was furnished with a pair of futuristic plastic pedestal chairs, a futuristic coffee table and thick blue shag carpeting. The room looked like the crews' recreation room on "Star Trek." One wall of the viewing room had a large plate glass window in

it. On the other side of the glass was an IBM 1620 computer. There were three men in white lab coats running around the computer like drones servicing a queen bee. The computers' memory capacity was 24,000 characters. Wow, isn't science wonderful. I was impressed! Today we'd call that 24K bytes. A 9 chip set of 64K bytes of memory can be purchased for under $20.00, at most 7-11's in Palo Alto.

That same semester my roommate was signed up to take "Engineering Communication," a euphemism for a computer literacy course. Each evening he would pack all of his homework into a book bag and trudge off to the Computer Center. He'd return about midnight frustrated to the point of tears carrying a stacks of IBM cards and some green and white printouts covered with cryptic notations about errors.

The process to produce this considerable level of frustration must have been arrived at by a mind equal to Dante. The first step was to stand in line ten to twenty minutes to type your program on a keypunch machine. If you made a typo on a card you would have to retype the entire line. The time limit on the keypunch was ten minutes then it was back to the end of the line. If you were a hunt and peck typist you were in for a long stint. Once your program was typed you would turn it in at the I/O window and wait a half hour until your program was run. The process was setup to maintain high throughput for faculty jobs. Student FORTRAN

jobs were run only on the hour and the half hour. When you got your program back it was back in line to re-keypunch the cards with errors.

I was delighted with my decision to take Speech Communication not Engineering Communication. In speech we gave a five minute speech about once every other week and everyone in class applauded no matter how bad your speech was. I determined then and there to avoid computers totally! This was my first experience with computer anxiety and I hadn't even had the experience to provoke it myself. I just observed my roommates frustration.

My next experience with computer anxiety came about nine years later when I was in graduate school at Wayne State. I got talked into taking a service course from one of the other departments entitled "Computer Uses in Research." During the time I was in grad school I was the only student that I was aware of taking a computer course. The operating system had improved greatly while I sat on the computing sidelines. Wayne had an IBM 360 /67, real heavy metal for those days. The system ran MTS, a time share operating system. Each user sat at a Selectric typewriter terminal and entered programs using a line editor. The prospect of taking a computer course terrified me. I got an ID and password the first class meeting. The next day I went to a public terminal in the University Library to experiment with the computer and see if

there were any computer games like football or golf available. I sat down at one of the terminals and logged in. I typed in football. The computer did nothing. I tried typing in "play football." The computer did nothing. I tried "run football." Again nothing. I tried one thing and another for about a half hour and got nowhere. In frustration I typed "go to hell." The computer replied "HELL DOES NOT EXIST." Woody Allen said that inanimate objects are anti-Semitic and now I was sure they were agnostic too. I grabbed the plug and pulled it from the wall, like Jeff Morrow, the scientist who built an alien machine in the "B" science fiction movie "This Island Earth." It was a couple of weeks before I got my nerve up enough to go back and try the computer again. It was some months before I learned that the operating system just responded to a "GOTO" as a file seeking command.

I don't think that these personal experiences are unique to first time computer users. Shore (1987) points out that computer anxiety takes three forms: anxiety about using computers, anxiety about dealing with computers, and anxiety about the effect computers will have on our society. The anxiety about using computes is very often based on a fear "that computers are too difficult, too technical, and to unfamiliar." For many people computers are seen as being an adversary. They are afraid that a computer will make them look stupid or feel foolish. Rubin points out that this is

why many business people resist computers (1983). Executives are afraid that their subordinates will discover there is something they can't master (p. 57).

Some people fear that they will do something causing the computer to produce unpredictable consequences. It might beep, lockup or do something completely unexpected. This includes the fear that they might break the computer, destroy valuable data, give an incorrect command, or worst of all make it beep! Professionals in computer science and data processing certainly aren't helping when they use euphemisms like system crash, or talk about a program bombing. On the Apple Macintosh when there is a system failure a window opens containing an icon of a bomb with the fuse lit.

Computer anxiety has been operationally defined by Jones and Wall (1985). Computer anxiety is a transitory anxiety experienced by individuals who perceive computers as being threatening. The anxiety produces worry and fear concerning performance and shifts attention from a task orientation to self-judgment. Physiological symptoms produced are increased heart rate, elevated blood pressure and digestive disorders. Shore observed the reactions of staff members when a computer was brought into an office as including hyperventilation, vomiting and attempts to destroy the offending machine (p 14).

The symptom that I have seen most often in students is keyboard paralysis. Some undergraduates enrolled in empirical

research courses when given an introductory computer exercise never get past sign-on. When asked to type a zero they type the letter "o." Students easily become frustrated and annoyed. They keep making mistakes and don't understand what they are doing wrong. They have trouble controlling the computer. After several failed attempts students may just sit at the CRT and stare at the keyboard for up to half an hour.

What causes computer anxiety? Ralph Waldo Emerson said: "Fear always springs from ignorance." This is certainly an oversimplification of a very complex problem. Jones and Wall, Loyd and Gressard (1984), and Bellano and Winter (1985) found that computer anxiety was closely related to math anxiety. Those students with a high level of computer anxiety also expressed a high level of math anxiety. Computer anxiety is a fear of failure and the fear of a loss of self esteem due to threat of failure. A major concern in any computer literacy course has to be computer anxiety. Howard and Glenn (1987)in a pretest-posttest study of the effect of a computer literacy course on computer anxiety found that participation in such a course significantly reduces computer anxiety (Howard & Glenn, 1987 p 20).

Computer anxiety is a significant problem for many students. Numerous bright students, who do well in all their other classes, drop communication research. The computer industry has been aware of the problem of computer anxiety.

The solution has been the development of systems, system software, and applications that are inherently user friendly. The first such system was the Apple Macintosh, introduced in January 1984. Apple described their new system as a solution to computer anxiety:

> The Macintosh is designed to appeal to an audience of non-programers, including people who have previously feared and distrusted computers. To achieve this goal, Macintosh applications should be easy to learn and to use.... The user should feel in control of the computer, not the other way around This is achieved in applications that embody three qualities: responsiveness, permissiveness, and consistency (Apple, (1985), p 1).

The appeal of the Macintosh is the use of the graphic user interface (GUI). The GUI allows the user to load and run an application through the use of a pointing device called a mouse. Most operations are carried out through a menu system. This avoids requiring the user to memorize any commands and allows any operation to be carried out at any point in the program, not just when a menu is displayed. The GUI has become very popular with users. Microsoft has successfully marketed Windows, a GUI for the MS DOS operating system. IBM has marketed OS/2 as a GUI. Finally, one of the founders of Apple, Steve Jobs has developed the NeXT computer that uses a UNIX GUI.

Does the use of the GUI reduce the level of computer anxiety for the novice user? The purpose of this study is to investigate the effect of computer interface on computer anxiety. The following hypothesis is suggested: novice

computer users will display a reduction in computer anxiety following an experience utilizing a GUI, compared to novice users utilizing a command line interface.

REVIEW OF THE LITERATURE

A proprietary study, conducted for Apple Computer by Diagnostic Research, compared user evaluation of the Macintosh and MS DOS. Among 1000 MIS managers at Fortune 1000 corporations, 22% rated Macintosh higher for over-all satisfaction. The Macintosh was rated 42% higher for productivity. Apple concludes that the Macintosh is an easier computer to use:

> "And a computer that people can't - or won't - use doesn't really have any power at all." (Scientific American, p. 121).

This has been the copy platform for Macintosh. That Macintosh is the computer for the rest of us. The preface to the Macintosh SE manual states that its "easy to learn, and really fun to use" (p. xi). This claim is based on the fact that Macintosh was the first mass market personal computer to use the GUI. Has the GUI been shown to make computers easier to use?

Fenton (1987) studied the effect of user interface on novice users. The effect of depth and breath of menus on errors, and search time were investigated. Subjects tested four menu designs: 2^6, 4^3, 8^2, and 64^1. These menus took the form of a tree structure. The 2^6 menu was a menu with two

choices leading to another menu of two choices leading to additional menus of two choices down to a sixth menu. An Apple IIe was used to test fourty intro research undergraduates. It was found that search time was faster and fewer errors were made with the broadest menus. Also subjects with low anxiety had better performance with menus of greater depth (2^6, and 4^3). There was no improvement for subjects with higher level anxiety. However, the effect of menu on the level of anxiety was not investigated.

Three interface designs were in a study by Hauptmann and Green (1983). Command language, menu selection and natural langua ,e interfaces were tested for the task of building bar graphs. The underlying concept was that a natural language interface would be easier to use than a menu or command language. Time for task completion, number of errors and user satisfaction with the interface were measured. There was a significant difference between the number of errors produced by the different interfaces. There was no significant difference between the interfaces and subject attitudes towards the interface. The hypotheses that the natural language interface would be easier to use than the command language or menu system was rejected.

The meaningfulness of icons as compared to commands was measured in a pair of experiments by Guastello, Traut, and Korienek (1989). Two sets of icons and two sets of verbal

commands were developed for rating by two groups. A combination of icon and verbal commands was also rated by the two groups. The first group of icons and commands were rated by operating engineers. The second set of icons were rated by students. A significant difference was observed based on the previous computer experience of the subjects. Those subjects that had experience with text based computers rated the commands more highly than the icons. Those subjects that had experience with icon based computers rated the icons more highly. Icons were not rated as being universally more meaningful.

The previous research found no user preference for icons. However the research to this date on icons has been limited. A study by Howard and Glenn (1987) studied the effect of "user friendly" software on computer anxiety. Two programs were used in an introductory computer course, BASIC and VISICALC. BASIC was defined as "user friendly." VISICALC was defined as "user unfriendly." The use of user friendly software had no significant effect on the students level of anxiety. Defining VISICALC as "user friendly" is certainly an overstatement. The effect of "user friendly" software on novice users requires further research.

Apple's claim of a preference among users for the GUI is reasonable. However, little research has been done on the effect of software on the anxiety level of novice users. The

effect of the GUI and icon based operating systems requires additional research.

METHOD

Subjects

The subjects for this study were 45 students enrolled in the undergraduate research course at a large urban university in the Midwest (22 males, 23 females). Experimental mortality accounted for the loss of 4 subjects. Two subjects did not correctly complete the pretest while two subjects did not participate in the experiment.

Measures

Computer anxiety, and computer literacy were measured in the pretest. Computer anxiety was measured as a post-test. The measure of computer anxiety consisted of sixteen Likert type items. The sixteen items selected were items that had loaded on the computer anxiety scales developed by Bandalos and Benson (1989), and Gressard and Loyd (1985). Computer literacy was measured using a twenty one question quiz. A second measurement of computer literacy was a sixteen item self assessment of computer skills (Murphy, Coover, & Owen, 1988).

The reliability for the index formed by combining the sixteen items measuring computer anxiety was calculated using Cronbach's Alpha (α=.8496). The reliability of the sixteen

items self assessment of computer skills was computed in the same manner (α=.9537). Both the index for measuring computer literacy and the index for measuring the self assessment of computer skills were concluded to be sufficiently reliable.

Procedure

Subjects were randomly assigned to two groups. Each group ran a program for generating random telephone numbers for exchanges furnished by the users. The experimental group ran the program on a Macintosh. The control group ran the program on an IBM PC. The Macintosh version of the program was written to take advantage of the Macintosh's graphic interface. The Macintosh version of the program was run by double clicking on the program "Icon" after opening the disk "Icon" on the desk top. The menu bar had two selections (see figure 1). The first selection was "File" and conformed to suggestions for program interface in Macintosh Revealed. Two options were present under the "File" option: "Print," and "Quit." "Print " inquired how many random phone number the user wanted for each exchange and then printed them out. The "Quit" selection returned the user to the desk top. The "Exchange" selection allowed the user to select additional exchanges or clear all exchanges. Any item in the menu could be selected by the user at any time.

The PC program was run by typing the program name on the command line. The program prompted the user for the number of

exchanges that would be entered. The user was then prompted for each exchange. After all of the exchanges were entered the user was prompted for the number of random phone numbers to generate. The random numbers were then printed out without any additional user input.

Both programs were written in Turbo Pascal. Subjects were given the pretest two weeks before running the program. The posttest was given immediately after the subjects ran one or the other programs.

RESULTS

A one factor ANOVA with three covariates was performed (see table 1). The pretest measure of computer anxiety, computer literacy, and self evaluation were used as covariates. The use of the pretest as a covariate is suggested by Campbell and Stanley (1966) and is judged to be superior to the commonly used t-test between pretest posttest gains. No significant difference was observed due to the main effect, and the effect of computer. The use of the GUI did not have the effect of reducing the novice users' computer anxiety.

Table 1
ANOVA of Computer for Anxiety by Computer
Pretest of Computer Anxiety, Computer Literacy Score,
and Self Evaluations of Computer Literacy Were Covariates

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig
Covariates	2025.249	3	675.083	10.242	.000
Pretest	1166.980	1	1166.980	17.705	.000
Literacy	1.005	1	1.005	.015	.902
Self evaluation	129.082	1	129.082	1.958	.170
Main Effects	3.843	1	3.843	.058	.811
Computer	3.843	1	3.843	.058	.811
Explained	2029.092	4	507.273	7.696	.000
Residual	2306.908	35	65.912		
Total	4336.000	39	111.179		

The covariates of computer literacy and self evaluation of computer literacy were not significant. The covariate of pretest of computer anxiety was significant. A significant relationship exists between the pretest and posttest. This indicates there was no change between the pretest and the posttest.

DISCUSSION

Interface does not have an effect on the level of computer anxiety for novice users. It was expected that GUI, employed by Macintosh and Windows, would produce a drop in user anxiety. However, no reduction in anxiety of novice users was observed. The GUI is not intuitively obvious to the novice user. The Macintosh has a very steep learning curve. For the novice user the GUI does not have an advantage over the command line interface. The GUI's advantage, for the

novice user, may be after the initial learning phase. After the basics of the GUI are learned, all of the high level functions become available. Longitudinal studies need to be conducted to investigate if the level of anxiety of novice users drops faster when a GUI is used.

There appears to be no simple solution to computer anxiety for novice users. The use of the GUI, no matter which platform is employed, will not reduce novice user anxiety. Other approaches must to be employed to deal with novice user anxiety.

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